April - September 1963

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NORTHEASTERN FOREST EXPERIMENT STATION

Division of Watershed Management Research

Semi-annual Report October 1963

GENERAL

A Northeastern contingent of Irv Reigner, Ken Reinhart, Jim Hornbeck, Howard Lull, Art Eschner, Don Satterlund (Syracuse), and Dave Mader (Univ. of Mass.) spent July 8-10 at Coweeta, listening, with admiration, to the discourses of John Hewlett and company, and seeing how many good ways APW money can be spent. We had a fine visit. Also, during the past semester Lull visited all projects, calling the roll before Clark Holscher's 3-weeks inspection in August-September. Clark, too, visited all projects and exhibited great patience with our considerable capacity to see one side of any question--ours. One of our two manuscripts for Departmental bulletins (the one on weir construction) moved with all deliberate speed to Washington, the other, on solar radiation was revised and may yet reach the presses. The Hubbard Brook group moved into their new building and the Fernow fellows saw theirs get started. Ken Reinhart received a cash award for a bang-up job of writing the Fernow results (14 papers), and Irv Reigner, and wife June, spent 6 weeks in Europe seeing the sights including some watershed research.

FERNOW EXPERIMENTAL FOREST

Calibration analyses have been completed for Fernow Watersheds 6 and 7 and the decision made to treat these watersheds. For this analysis, we developed a revised procedure for determining adequacy of calibration: a procedure based on testing individual after-treatment values for significance (rather than using analysis of variance or some other method).

Originally, we planned to use Watersheds 6 and 7 (as a follow-up on the "package-deals" on Nos. 1 to 5) to separate timber-cutting effects from skidroad effects. We decided that this is not necessary; to a very large extent, in our experience, the increases in discharge are due to timber cutting and the damage to water quality is related to the skidroads.

So we have decided to make Nos. 6 and 7 into "benchmark watersheds". What will be the effect on streamflow, under local conditions, of complete vegetation removal? Logging (starting November 1, 1963) will be followed by poisoning of culls, poisoning of stumps, basal-spraying of small stems, and a follow-up foliage spray (in spring, 1964) to catch whatever is left. Later

treatments may also be necessary. We know we won't be able to kill that last leaf but we'll make a good try at it.

In an attempt to kill 2 birds, the watershed treatment will be by halves, upper and lower (with dividing line on the contour). In the first phase, Lower 6 and Upper 7 will be treated; the remaining halves will be treated 2 or 3 years later.

Jim Hornbeck has been busy taking calibration measurements of microclimate on Watersheds 6 and 7: Air temperature at standard and 6-inch heights, soil temperature at 2-, 4- and 8-inch depths, evaporation pan, and Bellani black-plate atmometer measurements.

Reinhart and Hornbeck visited Coweeta in July and Hibbert and Cunningham returned the call in August. At Coweeta, records of Fernow No. 4 are being compared with Coweeta streams. Some interesting things are showing up; for one thing, it appears that on the Fernow a much larger proportion of rainfall is included in the storm runoff. In neither area is overland flow involved, it is apparently a question of the rapidity of sub-surface flow.

--Ken Reinhart

HUBBARD BROOK EXPERIMENTAL FOREST

On-the-ground cooperative studies have been initiated with Dartmouth College at Hubbard Brook. Their interests lie in determining the inflow and outflow of minerals from an ecological system. Because of the tight bedrock restricting deep seepage, and the virtually unweathered bedrock surface upon which the glacial drift soil rests, the Hubbard Brook watersheds are ideal for such studies. We are presently cooperating with three professors (an ecologist, a limnologist, and a geologist) who are interested in the cycling of all elements in the watershed but initially concerned with calcium, magnesium, sodium, and potassium. Almost endless possibilities for study exist along these lines to help us gain more basic knowledge of our watersheds and their behavior--such as rates of weathering of bedrock and mineral and organic fractions of the soil; rates of surface organic layer accumulation; and phenological studies comparing occurrence of biological events, both plant and animal, with climate and streamflow.

A large portion of our time this summer was spent in developing our physical plant. Accelerated Public Works money enabled us to provide essential facilities for our new office-field assistants quarters and construct needed additional improvements, ready 3 new stream-gaging sites for construction, and start construction on one (this is number 7), and cut access trails and openings for a network of rain gages for three new watersheds. Also completed this summer were 2 miles of access

road to the three stream-gaging sites.

Stream-gaging Station #7 (to be completed this fall) will be a combined sharp-crested 1.25-foot 120° V-notch with a 4-foot San Dimas flume. This is designed to handle flows up to 235 cfs. on the 190-acre watershed. Identical structures are planned for 2 adjacent watersheds of 160 and 175 acres.

The educational leave bug is contagious. George Hart had hardly unpacked his bags after returning from graduate study at the University of Michigan when Ray Leonard departed for the ivory tower routine at Yale. Ray will specialize in microclimatology under Bill Reifsnyder.

--Bob Pierce

NEW LISBON

New Lisbon had both good and bad fortunes during the last half year. April was the bad month. First, Karl Nicholas suffered two broken vertebrae from lifting a bag of Sacrete. Then a wildfire burned over about half of the Lebanon State Forest, on which we are located, so we may be somewhat restricted for future study areas. The good fortune for Irv Reigner is his 6-week trip to Denmark, France, and Great Britain.

Newark Watersheds

Tabulations of precipitation are now up to date and show that the ridge station has been receiving consistently less rainfall than the stations at lower elevations. The ridge station is actually not on the ridge top, but on a 40-percent slope within the gaged watershed. To determine if the catch of this station is a representative sample of rainfall in the area or is affected by wind, two other gages have been installed: one equipped with an Alter windshield, and the other tilted perpendicular to the slope.

Another one of the concrete weirs has begun to leak. Watershed #2, which has the strongest sustained flow of the three watersheds, went dry this summer for the first time. With no flow over the notch, a leak in the front wall became visible. An attempt to patch the leak with asphalt and vinyl plastic sheeting was unsuccessful because enough water seeped into the weir to prevent the concrete from becoming entirely dry. A complete vinyl lining will be installed.

Baltimore Watersheds

For some time it has become increasingly evident that Watershed #3 was not yielding a reasonable streamflow through the weir. The tiny watershed, only 21.6 acres, has never been

dry in the summer but the winter flows are unreasonably low--not very much higher than the summer flows. A suspicion that part of the yield is leaving through underground geologic structures was tentatively confirmed by several visitors from the groundwater branch of the U.S. Geological Survey in June. We are now attempting to have a geological survey made of the watershed area.

Penn State Watersheds

The installation of access tubes for a neutron probe has hit a snag--or rocks. Bill Sopper has been able to place tubes on the Shale Hills Watersheds, but the sandstone rocks and cobbles on the Leading Ridge Watersheds have been too much for hand augers. On order now is a portable 2-1/2 HP power drill from Forestry Suppliers. This will afford a worthy comparison to the "Little Beaver" power auger which was described by the Central States' report in March 1962.

Field work for the water contamination study is now complete. The streamside reaches that were sprayed last summer were recently examined for effectiveness of kill. The results were surprisingly good, and in the Newark area at least the emulsifiable acid showed about as good results as the more common ester of 2,4,5-T. The emulsifiable acid, which causes less contamination than the ester, was not expected to provide as good a kill.

General

Some rather ancient interception data from the Poconos was analyzed in preparation for publication. The first step was an evaluation of the trough gages used to measure rainfall and throughfall. It was found that the trough gages did not measure total rainfall accurately, that some of it splashed out of the troughs. An interesting analysis showed that this loss decreased as the slope of the trough increased. When the slope reached 25 percent, the loss became zero, indicating that the raindrops no longer bounced out, but were deflected into the trough. The older California studies, which recommended trough gages highly, were conducted on slopes of 30 to 40 percent, thus substantiating the above interpretation.

A comparison was made of monthly soil moisture changes as measured at Dilldown with estimates from the Thornthwaite method (daily basis). They were very similar, so close that we are now more confident of the accuracy of the measured values. Thus, the Thornthwaite method produces two estimates of the water balance cycle that seem to be quite accurate--actual evapotranspiration and soil moisture change.

Thornthwaite's method of estimating available gravitational water would not be useful in estimating runoff for a watershed having true groundwater such as the Dilldown Watershed. But for those watersheds having little or no groundwater storage, Thornthwaite's estimate of runoff might be an extremely useful statistic to use in single watershed calibration. In a monthly analysis, for example, the estimated runoff (based on climatic data) could be used as an independent variable in a simple regression with measured runoff as the dependent variable. The regression developed during the calibration period could then be used to detect treatment changes.

Looking toward our proposed study of heat and energy relations, we again examined our ancient, obsolete anemometers. Tests some years ago indicated that no two instruments gave comparable results when exposed side by side. Overhauling according to instructions had little effect. Then we noticed that the bottom of the spindle shaft, which rests on the bottom bearing plate, had become flattened on the slower instruments. A little grinding and polishing of the spindle shaft, to again make it round instead of flat, has made a world of difference in these anemometers.

Trying to find an inexpensive method to measure the pH of streams, we investigated Hydrion papers. These papers can be obtained in many ranges of pH and are commonly used in industry and medicine. However, while they worked in some ranges of water pH, they were not sensitive in all ranges. Some correspondence with the manufacturer confirmed our suspicion that the stream waters are too lightly buffered to react with the papers. It appears that we should obtain a Helige Comparator, unless someone has a better idea.

--Irv Reigner

SYRACUSE

Most of the past six months has been spent in field work, or preparing for field work. We made a fairly extensive ecological survey of the 491 square mile Sacandaga watershed to define vegetation changes occurring over the 50 years for which a streamflow record is available. In selected stands the present stocking and past growth and mortality were determined, as well as estimates of crown cover by evergreen species and the deciduous group. Crown depth information and soil descriptions were also taken in the stands studied. Summaries of these data, and other historical records, will be used in an attempt at explaining the large decrease in dormant season streamflow and the smaller decrease in growing season streamflow mentioned in previous semi-annual reports.

Two joint papers were given at meetings during the past half year--Don Satterlund gave one on Land Use, Snow and Streamflow Regimen in Central New York at the A.G.U. meeting in April in Washington, and Art Eschner gave one at a Forest Land Use Conference in Albany in September on Forest Land Use Problems as Seen by the Water User.

--Art Eschner

PUBLICATIONS

Snow and frost conditions in New Hampshire, under hardwoods and pines and in the open. George Hart. Jour. Forestry 61: 287-289, 1963.

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Efficient logging protects water quality. Kenneth G. Reinhart. South. Lumberman 206: 39,42, 1963.

Some observations on precipitation measurements on forested experimental watersheds. Raymond E. Leonard and Kenneth G. Reinhart. U. S. Forest Service Res. Note NE-6, Northeast. Forest Expt. Sta.

Cutting the forest to increase water yields. George R. Trimble, Jr., K. G. Reinhart, and Henry H. Webster. Jour. Forestry 61: 635-640, 1963.

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Manuscripts submitted:

What's new in municipal watershed management. H. W. Lull and Donald R. Satterlund.

A forest atlas of the Northeast. Howard W. Lull.